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ABSTRACT

The passage of the Chicago (Illinois) School Reform Act introduced a model of schools called the production model. This model defines the structures of the school by its inputs, throughputs (or production process), and outputs. The production model produces quantitative reports describing the fiscal condition and the quality of output, thus creating a fiscal scorecard. Survey responses from 10,170 teachers from 331 Chicago schools were the data for an analysis using partial least squares path analysis (PLSPath). PLSPath indicates causal relationships between latent variables and reflects the relative strength of the latent constructs defined by its manifest variables. Analysis of survey responses indicates that teachers see themselves as the central characters within the school and the sole determinant of the productive output. However, the races of the students, the organizational health of the school, and, on occasion, the external community determine the output. Data also suggest that the teachers view the principal as a deliverer of goods and services who maintains the teachers' commitment to productivity. Suggestions for further research include attention to the role of money in the model. (Contains 5 tables and 29 references.) (SLD)

CHICAGO SCHOOL REFORM AND THE PRODUCTION MODEL

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The passage of the Chicago School Reform Act, PA 85-1418 introduced a model of schools called the production model. Historically the State of Illinois has viewed the school system as an educational production function model. (Wong, 1989) This model focuses on one or two outputs from the system and designs a measurement device to evaluate the quality of the output. The production model produces quantitative reports describing the fiscal condition and the quality of the output; creating a fiscal scorecard. (Haitman, 1988; Nixon, 1992) The production model defines the structure of the school by its inputs, throughputs (or production process), and outputs. In Illinois, the State reports the progress of each school through the school budget and the school's adherence to the School Improvement Plan (SIP). This annual publication, called the school's report card, includes the Illinois Goal Assessment Program (IGAP) standardized achievement scores. In Chicago, sections of the reports are published in the daily newspapers.

Prior to the passage of the act, two essential community groups in Chicago school reform legislation, Designs for Change and Chicagoans United to Reform Education, offered a different model for analysis of the system, The Quality of Experience model. This model examines variables such as the quality of the students' educational experience through improvements to the school's organization, resource allocation, organizational patterns, subculture, professional participation, and professional development. (Moore and Pandya, 1992)

Some researchers have argued the intent of the production model. Monk (1992, 1993) offers that the production—function is a model for analysis, and like any model it could be subject to misuse. Hodas (1993) suggests that the model is a nineteenth century concept, like

scientific management. It encourages a top—down, judgmental management style, where central office makes decisions based on imposed standards.

Most researchers of major metropolitan school systems have identified common variables within the system for the student, teachers, administrators, the organization, and parents. (Havighurst, 1964; Rodgers, 1968; Walberg, 1988; Goldring and Shapira, 1993; Bliss, Firestone, and Richards, 1991) Some have added to the production model by including the variable, collegiality. (Witte and Walsh, 1990; Barth, 1991; King, 1994) Others have studied directive school leadership, positive school climate, and student motivation. (Murphy, 1989; Willins and Kerckhoff, 1995) Others have examined teachers' empowerment. Smiley (1994) while examining teacher empowerment has suggested correlational relationships between the amount of teacher empowerment, the type of leadership, and the organizational health of the school.

In the heat of legislative change, the legislation did not include methods to evaluate the reforms suggested in the act. The various models share common latent constructs and goals, enough so that all can be accommodated within a production model enhanced to include external influences to the school. (Brumback, 1986) Common latent constructs are the relationship of the school to its external environment, the degree of teacher empowerment, the extent and quality of the leadership in the school, the morale present, and the quality and quantity of the school's output. Finally, The Chicago Public Schools signaled its acceptance of the model with the appointment of a CEO, not a superintendent, overseeing its schools.

In 1991, the Consortium on Chicago School Research published *Charting Reform: The Teachers' Turn,* descriptive statistical data from their survey of Chicago Public School teachers. Using this data as a base, I examined the survey responses of 10,170 teachers from 331 schools filtered through PLSPath version 3.1, a software that performs Partial Least Squares Path analysis on the model. The model consists of 7 latent variables, and 21 manifest variables. Race the percentage of Black or White enrollment in the school, and Money, the net budget of the school in 1989, were exogenous variables. The five endogenous variables are External Relations, Teacher Empowerment, Leadership, Organizational Health, and Output. Output is a composite variable made up of three manifest variables student achievement using the Illinois Goal Assessment Program (IGAP) tests from 1989, Professional Practices Advisory Council (PPAC) performance, and Local School Council (LSC) performance.

Does the relationship of the latent variables, arranged in this open systems production model, offer information to enhance the understanding the operation of the school system. It is my contention that the production model examined using partial least squares path analysis (PLSPath) enhances the understanding of the school system's operation. (Valente, 1998) Based on a theoretical model, PLSPath indicates causal relationships between the latent variables, and reflects the relative strength of the latent constructs defined by its manifest variables. By knowing the relationships between the variables, researchers and administrators can examine different configurations of the model to achieve better understanding of the system.

Falk & Miller (1992) define soft modeling and its use with social science, "With soft theory and soft observations which do not meet closed system conditions, it is unlikely that

invariant structural parameters (LISREL's causes) can be established. A properly defined and estimated closed system, however, requires that a set of theoretical, measurement, and distributional conditions be met. As one moves farther away from the powerful conditions for a required for a closed system, the concept of causation must be abandoned and replaced by the concept of predictability. While causation guarantees the ability to control events, predictability allows only a limited degree of control." To be able to predict with 100% accuracy you will need to its cause, this means you *know* what will happen under certain circumstances. "In the abstract, 100% predictability means that all of the variation that occurs in some event is understood."

I prefer to consider causality as Lohmöller argues, that it is really a cause-effect relationship. (Lohmöller, 1989) Acknowledging that causality is a theoretical construct, as humans we do have an inborn desire to understand our surroundings. A cause-effect relationship more closely resembles both the cognitive model and the historical basis for Cameron's model the work by Katz and Kahn. (Cameron, 1978; Katz and Kahn, 1978)

I drew relationships between the exogenous variables and all of the endogenous variables. Within the endogenous variables, I examined a sequenced relationship starting with the external relationships of the school, and ending with the examination of the output. Each latent construct had hypothesized unidirectional relationships with all succeeding constructs.

The model consists of an inner and outer model. The outer model shows the relationship of the manifest variables to the latent construct. The inner model shows the causal relationships between the latent constructs. The tables listed below show the relationships.

Table I Inner model statistics for Black enrollment

Variable	Beta	Correlation	Delta	Tolerance	Pred. L.V.s	R-square
External					2	0.185
Money	-0.116	-0.161	0.013	0.013		
Race	-0.401	-0.414	0.159	0.013		
Empower					3	0.384
Money	0.019	-0.075	0.000	0.028		
Race	0.114	-0.158	0.011	0.174		
External	0.661	0.611	0.356	0.185		
Leaders					4	0.758
Money	-0.007	-0.088	0.000	0.029		
Race	0.112	-0.104	0.010	0.188		
External	0.247	0.640	0.031	0.483		
Empower	0.718	0.852	0.318	0.384		
Health					5	0.745
Money	0.018	-0.099	0.000	0.029		
Race	-0.037	-0.270	0.001	0.220		
External	0.417	0.769	0.079	0.543		
Empower	0.112	0.732	0.003	0.734		
Leaders	0.424	0.788	0.043	0.758		
Output					6	0.683
Money	-0.058	-0.169	0.003	0.030		
Race	-0.041	-0.306	0.001	0.224		
External	0.399	0.761	0.056	0.651		
Empower	0.253	0.699	0.017	0.737		
Leaders	0.079	0.693	0.001	0.793		
Health	0.170	0.741	0.007	0.745		

Table II Inner model summary statistics for White enrollment.

Variable	Beta	Correlation	Delta	Tolerance	Pred. L.V.s	R-square
External					2	0.37
Money	-0.0445	-1.631	0.0019	0.0394		
Race	0.5979	0.6067	0.3434	0.0394		
Empower					3	0.384
Money	0.0037	-0.073	0	0.0423		
Race	-0.1918	0.2427	0.0229	0.3783		
External	0.7174	0.6004	0.3242	0.37		
Leaders					4	0.75
Money	-0.0106	-0.0886	0.0001	0.0423		
Race	-0.824	0.2437	0.0041	0.4005		
External	0.2446	0.6306	0.0247	0.5872		
Empower	0.7232	0.8509	0.3222	0.3839		
Health					5	0.752
Money	0.0301	-0.099	0.0009	0.0427		
Race	0.1233	0.4645	0.009	0.4102		
External	0.3489	0.7659	0.0457	0.6244		
Empower	0.124	0.7291	0.0041	0.7311		
Leaders	0.4325	0.7853	0.0467	0.7505		
Output					6	0.698
Money	0.0445	-0.1709	0.0019	0.046		
Race	0.1319	0.5068	0.0099	0.4307		
External	0.3595	0.7671	0.041	0.6828		
Empower	0.2641	0.695	0.0184	0.7355		
Leaders	0.1028	0.6896	0.0022	0.7899		
Health	0.1265	0.7408	0.004	0.7515		

Table III A comparison R^2 and Q^2 of the latent variables.

	Black enrollment		White enrollment	
Latent Variable	R^2	Q^2	R^2	Q^2
External	.185	.156	.370	.351
Empower	.384	.366	.384	.366
Leaders	.758	.751	.750	.748
Health	.745	.734	.752	.741
Output	.683	.670	.689	.685

Table IV. Outer model jackknife results for Black enrollment.

Variable	Loading	Jkn. Mean	Jkn. SD	Comm.	Jkn. Com.	Redundancy	Jkn. Red.	Mode	Jkn.Con (Block)
Money								Unity	1
net budget	1	1	0	1	1	0	0		
Race								Unity	1
Black	1	1	0	1	1	0	0		
External								Outward	0.578
Lowincome	-0.746	-0.746	0.030	0.556	0.550	0.103	0.086		
Mobility	-0.608	-0.608	0.039	0.370	0.362	0.068	0.056		
Attendance	0.771	0.771	0.022	0.595	0.589	0.110	0.092		
Parinvl	0.880	0.880	0.010	0.775	0.772	0.143	0.120		
Extrelation	0.788	0.788	0.024	0.621	0.616	0.115	0.096		
Empower								Outward	0.747
Efficacy	0.806	0.806	0.019	0.650	0.646	0.250	0.237		
Influence	0.890	0.890	0.000	0.791	0.789	0.304	0.289		
Voice	0.900	0.900	0.010	0.809	0.807	0.311	0.296		
Leaders								Outward	0.564
Competency	0.200	0.200	0.050	0.040	0.028	0.030	0.021		
Knwsip	0.657	0.657	0.032	0.432	0.424	0.327	0.319		
Leadership	0.916	0.916	0.009	0.839	0.836	0.636	0.628		
Mission	0.926	0.926	0.006	0.857	0.855	0.650	0.642		
Schorder	0.824	0.824	0.020	0.678	0.674	0.514	0.506		
Health								Outward	0.572
Collegiality	0.803	0.803	0.023	0.644	0.640	0.480	0.470		
Cleanliness	0.661	0.661	0.033	0.437	0.431	0.326	0.317		
Safety	0.806	0.806	0.000	0.650	0.646	0.484	0.474		
Output								Outward	0.546
Lscprf	0.761	0.761	0.018	0.579	0.573	0.395	0.384		
Achieve	0.710	0.710	0.030	0.504	0.496	0.344	0.322		
Ppacprf	0.758	0.758	0.027	0.574	0.569	0.392	0.381		

Table V. Outer model jackknife results for White enrollment.

Variable	Loading	Jkn. Mean	Jkn. SD	Comm.	Jkn. Comm.	Redundancy	Jkn.Red.	Mode	JknCom (Block)
Money								Unity	1.000
net budget	1.000	1.000	0.000	1.000	1.000	0.000	0.000		
Race								Unity	1.000
white	1.000	1.000	0.000	1.000	1.000	0.000	0.000		
External								Outward	0.580
parinvl	0.870	0.870	0.007	0.757	0.754	0.280	0.265		
exrelation	0.775	0.775	0.027	0.601	0.596	0.223	0.209		
attendance	0.770	0.770	0.020	0.593	0.587	0.219	0.206		
lowincome	-0.763	-0.763	0.023	0.582	0.577	0.215	0.203		
mobility	-0.627	-0.627	0.036	0.394	0.386	0.146	0.136		
Empower								Outward	0.747
efficacy	0.804	0.804	0.022	0.642	0.642	0.248	0.235		
influence	0.890	0.890	0.016	0.793	0.790	0.304	0.289		
voice	0.901	0.901	0.019	0.811	0.809	0.311	0.296		
Leaders								Outward	0.564
competency	0.205	0.205	0.050	0.042	0.030	0.031	0.022		
knwsip	0.661	0.661	0.029	0.436	0.429	0.327	0.319		
leadership	0.914	0.914	0.011	0.836	0.834	0.628	0.619		
mission	0.926	0.926	0.005	0.857	0.856	0.643	0.635		
schorder	0.821	0.821	0.025	0.675	0.670	0.506	0.498		
Health								Outward	0.574
collegiality	0.795	0.795	0.023	0.632	0.628	0.475	0.466		
cleanliness	0.671	0.671	0.026	0.450	0.445	0.338	0.329		
safety	0.807	0.807	0.019	0.652	0.648	0.490	0.480		
Output								Outward	0.545
lscprf	0.754	0.754	0.022	0.568	0.563	0.397	0.385		
Achieve	0.724	0.724	0.026	0.523	0.517	0.366	0.354		
Ppacprf	0.748	0.748	0.024	0.560	0.555	0.391	0.380		

Tables IV and V provide the outer model results. The outer model is the relationship of the manifest variables with the latent variable. The category, mode, shows how that variable was loaded into the PLS path software. Money and Race are labeled unity, because these exogenous

latent variables are defined by a unique manifest variable. Outward is a way showing the differentiation between reflective and formative indicators. Outward predictor variables, "reflect" the latent construct. (Sellin, 1989) Using Empower as an example, voice is one of the many ways of describing the latent construct.

The column labeled loading is that manifest variable's predictive power with the latent construct. A negative coefficient removes the manifest variable from the latent construct. An example is the loading of the manifest variables, lowincome, and mobility, with External in the black enrollment results. This is another indication that these manifest variables will not appear in the final nomogram.

The next two columns, jackknife mean and jackknife standard deviation, are treated the same ways that the latent variable jackknife mean and standard deviation were treated. In this instance, PLSPath jackknife procedure calculates regression equations omitting one case at a time until the entire sample is analyzed. A difference greater than three between the two statistics is significant. Table V indicates that the negative jackknife means, for lowincome and mobility, add a second argument to remove both manifest variables.

The PLS Path software provides four different statistics on the predictive power of each of the manifest variables as they relate to the latent variable. Communality is the squared correlation between the manifest variable and the latent variable. The fifth column, Jackknife communality, and the final column, Jackknife communality (Block) are calculated by squaring the jackknife mean. The jackknife block calculation represents all of the jackknife statistics for

all of the manifest variables for the latent variable.

Redundancy presents the final statistic of predictive power in the two tables. Redundancy is the "predictive power" between the manifest variable and the latent variable, the lower the redundancy the lower the "predictive-ness" between that manifest variable and the latent variable.

Falk and Miller suggest rules of thumb for model evaluation. First, each latent variable should have at least three manifest variables. This model clearly meets this requirement. The loading between the manifest variables and the constructs should be greater than or equal to 0.55. Tables IV and V show that after removing the three manifest variables, lowincome, mobility, and competency, the loadings range between 0.657 and 0.916 for Black enrollment and 0.661 and 0.926 for White enrollment. These loadings result in average communalities of 0.64 for both White and Black enrollment.

Tables I and II present the R^2 the endogenous variables. For Black enrollment, the range is 0.185, for External, to 0.758 for Leaders: White enrollment has a range from 0.37, for External, to 0.752.

The latent predictor variable should account for at least 1.5 percent of the variance in a predicted variable. After deleting Money and Race from Black enrollment the predictor variables, External Relations, Empowerment, Leadership, and Organizational Health account for a range of variance from 36 to 64 percent of their respective predictor variables. The white

enrollment predictor variables include Race, since only Money is deleted from the paths, and its range is from 5 to 65 percent. Race accounts for five percent of predicted variables Teacher Empowerment, and Leadership.

In his applications manual Sellin (1989) discusses three values, Q^2, the Jackknife Mean, and the Jackknife Standard Deviation. Campbell (1997) notes that the Q^2 is used to give and estimation of the predictive relevance of that latent variable, while the Jackknife Mean versus the Jackknife Standard Deviation lends credence to the causal strength of that predictor path. Also Sellin offers the redundancies (Tables IV and V), squared correlations between the manifest variables and its latent construct, as another measure of the joint predictive power of the inner and outer model relationships as estimated for the data. The redundancies for this data range from 0.03 to 0.65 for the black enrollment data, and 0.02 to 0.64 for white enrollment. Where 0.03 and 0.02 represent competency, a very weak manifest variable, and the other extreme is mission, 0.65 to 0.64.

Based on a theoretical model, PLSPath indicates causal relationships between the latent variables, and reflects the relative strength of the latent constructs defined by its manifest variables. By knowing the relationships between the variables, researchers and administrators can examine different configurations of the model to achieve better understanding of the system. I drew relationships between the exogenous variables and all of the endogenous variables. Valente (1998) sequenced the relationships starting with the external relationships of the school, and ending with the examination of the output. Each latent construct had hypothesized unidirectional relationships with all succeeding constructs.

The exogenous variable, Money, as measured by the percentage of usable budget, net after salaries (usually 15% of the total budget) does not affect any of the endogenous constructs in the model. Money does not influence any of the variables to any statistically significant degree. (See Hanushek, 1989; Hedges and Laine, 1994; and Hanushek, 1994)

The second exogenous variable, Race, is a significant determinant of the relationships within the model. Teachers base their perception of the influence of the external relations on the heterogeneity or homogeneity of the student body of their school. This is regardless of the teacher's race. As the student body becomes more heterogeneous, all of the elements of the model come into play. Whereas as the student body becomes more homogeneous tending toward African American, the construct External Relations statistically drops off, leaving the endogenous variables Teacher Empowerment, Leadership, and Organizational Health to define the outcome. In effect, a homogeneous population denies the involvement of the parents and community.

The shift of External Relations' causal influence may be a reflection of social inconsistency, an institutional disparity between the teachers' words and deeds, or a reflection of the social immorality by the majority, teachers, on the minority, parents and community. (Chestang, 1972; Pinderhughes, 1988) This is despite fifty percent of the teachers being African-American. It may also reflect the societal projection process, where the teachers are creating, or maintaining an equilibrium that de-emphases the parents and community. (Feagin, 1996) Since the stable causal relationships remain intact, the difference is only with the relationship with

teachers. From Etzioni's (1975) standpoint, this may be an example of the dissatisfied teachers projecting their dissatisfaction with the goals and compliance structure outwards.

The latent construct, External Relations, is reflectively defined by five manifest variables. The manifest variables are teachers' perceptions of parental involvement, teachers' perceptions of the school and community relations, the percentage of daily attendance, the percentage of mobility, and the percentage of low-income students enrolled in the school. Two manifest variables, mobility and low-income, drop off from for lack of statistical relevance.

This research affirms the commonly held belief, that teachers are the principle cause of the output for the school. The teachers' affect on the organizational health of the school is statistically less significant than the principal. Leadership (principals) strongly affects Organizational Health, and only the organizational health of the school. The data suggests that principals do not have a statistically significant affect on the test scores, LSC, or PPAC. This is surprising since the first action taken, when the achievement falls, is to fire the principal.

It is the direct link, Leadership to Organizational Health, which defines the principal's strength. The latent construct, Organizational Health, has a weak statistical affect on the Output. It is this relationship, the leader's affect on the organizational health of the school, which describes the leader's role. The connection of Organizational Health to Output is not as significant as Teacher Empowerment. It is on par with Race, the race of the student population.

Four conclusions can be drawn from this analysis.

- Teachers do not perceive Money as significant in relation to the other latent constructs.
- The teachers perceive themselves as the primary affect on the performance of the school.
- Despite the race of the students, the relationship between the teacher, principal, and the organizational health of the school remain fixed and stable.
- As the enrollment becomes more heterogeneous, the model becomes more complete with the significance of the external environment coming into play, heightening the affect of race.

The implications of the conclusions are tantalizing. The teachers see themselves as the central character within the school, and the sole determinant of the productive output. Yet, the races of the students, the organizational health of the school, and on occasion the external community determine the Output. Desegregation of the schools works. As the racial balance in the school becomes more homogenous, the teachers discount the role of the parents and community.

This data suggests that the teachers view the principal as a deliverer of goods and services. The task of the leader is to maintain the teachers' commitment to the productivity, while drawing the parents and community into the school in a manner that the teachers find significant. School based, or site based, management works. The relation between principals and teachers improves, when it is based on empowerment. The data suggests that there is a

relationship between the teachers' years of experience and their empowerment. It seems that the older, more experienced teachers are not only more empowered, and seemingly less flexible.

The idea of flexibility, willingness to change behavior, is well known in the management literature, and beginning to be known in educational research as the "teacher veto." (Valente, 1999) The teacher veto can be known by the sustained inactivity, or ringing silence, on new activities. On teacher commented on the reforms made in Chicago by saying that she saw them before, and that if she works long enough, she will see them again.

The ideas culled from this data analysis suggest further research. Specifically, the principal's view should be explored in conjunction with the teachers'. The causal relation between the leadership, teacher empowerment, and organizational health suggests that there maybe more interconnectivity. In the original data, the assumption was that the causality moved from input to output. The conclusions suggest that there is a recursive, doubling back, of the causality between these three latent constructs. Finally, the latent variable, Money, should move within the diagram.

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